

CHAPTER 3**DRINKING WATER****3-1 SCOPE**

This Chapter contains criteria for providing potable water at DOD installations.

3-2 DEFINITIONS

3-2.1 Action Level. The concentration of lead or copper which cannot be exceeded in water specified in Criteria 3-3.2.d. This determines what kind of the treatment will be required for a water system.

3-2.2 Community Water System (CWS). A public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

3-2.3 Compliance Cycle. The nine-year calendar year cycle during which public water systems must monitor water quality. Each compliance cycle consists of three three-year compliance periods. The Environmental Executive Agent will determine when to start the initial compliance cycle.

3-2.4 Compliance Period. A three-year calendar year period within a compliance cycle. Each compliance cycle has three three-year compliance periods. The Executive Agent will determine when to start the initial compliance period.

3-2.5 Contaminant. Any physical, chemical, biological, or radiological substance or matter in water.

3-2.6 CT or CT_{calc}. The product of "residual disinfectant concentration" (C) in mg/L determined before or at the first customer, and the corresponding "disinfectant contact time" (T) in minutes, i.e., "CT". If a public water system applies disinfectants at more than one point prior to the first customer, it must determine the CT of each disinfectant sequence before or at the first customer to determine the total percent inactivation or "total inactivation ratio." In determining the total inactivation ratio, the public water system must determine the residual disinfectant concentration of each disinfection sequence and corresponding contact time before any subsequent disinfection application point(s). "CT_{99.9}" is the CT value required for 99.9 percent (3-log) inactivation of Giardia Lamblia Cysts. CT_{99.9} for a variety of disinfectants and conditions appear in Tables 3-11A through 3-11H.

$$\frac{CT_{calc}}{CT_{99.9}}$$

is the inactivation ratio. The sum of the inactivation ratios, or total inactivation ratio shown

$$\sum \frac{(CT_{calc})}{(CT_{99.9})}$$

is calculated by adding together the inactivation ratio for each disinfection sequence. A total inactivation ratio equal to or greater than 1.0 is assumed to provide a 3-log inactivation of Giardia Lamblia Cysts.

3-2.7 Disinfectant. Any oxidant, including but not limited to chlorine, chlorine dioxide, chloramines, and ozone added to water in any part of the treatment or distribution process, that is intended to kill or inactivate pathogenic microorganisms.

3-2.8 Disinfectant Contact Time ("T" in CT calculations). The time in minutes that it takes for water to move from the point of disinfectant application or the previous point of disinfectant residual measurement to a point before or at the point where residual disinfectant concentration ("C") is measured. Where only one "C" is measured, "T" is the time in minutes that it takes for water to move from the point of disinfectant application to a point before or at where residual disinfectant concentration ("C") is measured. Where more than one "C" is measured, "T" is (1) for the first measurement of "C", the time in minutes that it takes for water to move from the first or only point of disinfectant

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application to a point before or at the point where the first "C" is measured, and (2) for subsequent measurements of "C", the time in minutes that it takes for water to move from the previous "C" measurement point to the "C" measurement point for which the particular "T" is being calculated. Disinfectant contact time in pipelines must be calculated based on "plug flow" by dividing the internal volume of the pipe by the maximum hourly flow rate through that pipe. Disinfectant contact time within mixing basins and storage reservoirs must be determined by tracer studies or an equivalent demonstration.

3-2.9 Disinfection. A process which inactivates pathogenic organisms in water by chemical oxidants or equivalent agents.

3-2.10 Domestic or Other Non-Distribution System Plumbing Problem. A coliform contamination problem in a public water system with more than one service connection that is limited to the specific service connection from which the coliform-positive sample was taken.

3-2.11 Dose Equivalent. The product of the absorbed dose from ionizing radiation and such factors as account for differences in biological effectiveness due to the type of radiation and its distribution in the body as specified by the International Commission on Radiological Units and Measurements (ICRU).

3-2.12 First Draw Sample. A one-liter sample of tap water, collected in accordance with Criteria 3-3.2.d, that has been standing in plumbing pipes at least 6 hours and is collected without flushing the tap.

3-2.13 Groundwater Under the Direct Influence of Surface Water (GWUDISW). Any water beneath the surface of the ground with (1) significant occurrence of insects or other macroorganisms, algae, or large-diameter pathogens such as *Giardia* *Lambia*, or (2) significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface water conditions. Direct influence must be determined for individual sources in accordance with criteria established by the Executive Agent. The Executive Agent determination of direct influence may be based on site-specific measurements of water quality and/or documentation of well construction characteristics and geology with field evaluation.

3-2.14 Gross Alpha Particle Activity. The total radioactivity due to alpha particle emission as inferred from measurements on a dry sample.

3-2.15 Gross Beta Particle Activity. The total radioactivity due to beta particle emission as inferred from measurements on a dry sample.

3-2.16 Initial Compliance Period. The first full three-year compliance period which begins after the Japan Environmental Governing Standards are published. The exact date of execution will be decided by the Environmental Executive Agent.

3-2.17 Langelier Saturation Index. A calculation based on the pH and hardness of a treated water which gives an indication of the potential of the water to accelerate corrosion of components of the distribution system.

3-2.18 Lead-free. A maximum lead content of 0.2 percent for solder and flux, and 8.0 percent for pipes and fittings.

3-2.19 Lead Service Line. A service line made of lead which connects the water main to the building inlet and any lead pigtail, gooseneck or other fitting which is connected to such lead line.

3-2.20 Maximum Contaminant Level (MCL). The maximum permissible level of a contaminant in water which is delivered to the free-flowing outlet of the ultimate user of a public water system except for turbidity for which the maximum permissible level is measured after filtration. Contaminants added to the water under circumstances controlled by the user, except those resulting from the corrosion of piping and plumbing caused by water quality, are excluded.

3-2.21 Non-public Water System (NPWS). A system which is not a public water system. For example, a well serving a building.

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- 3-2.22 Picocurie (pCi). The quantity of radioactive material producing 2.22 nuclear transformations per minute.
- 3-2.23 Point of Disinfectant Application. The point where water downstream of that location is not subject to recontamination by surface water runoff.
- 3-2.24 Point-of-entry Treatment Device (POE). A treatment device applied to the drinking water entering a house or building for the purpose of reducing contaminants in the drinking water distributed throughout the house or building.
- 3-2.25 Point-of-use Treatment Device (POU). A treatment device applied to a single tap used for the purpose of reducing contaminants in drinking water at that one tap.
- 3-2.26 Population Served. The sum of all military, civilian and dependent personnel living on the installation plus one-third of the work force not living on the installation.
- 3-2.27 Potable Water. Water that has been examined and treated to meet the standards in this Chapter of the Japan Environmental Governing Standards.
- 3-2.28 Public Water System (PWS). A system for providing piped water to the public for human consumption, if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days of the year. This term includes both "community water systems" which serve year-round residents and "non-community systems", along with any collection, treatment, storage, and distribution facilities under control of the operator of such systems, and any collection or pretreatment storage facilities not under such control that are used primarily in connection with such systems. A non-community system is used by intermittent users or travelers and is sub-classified into a non-transient, non-community or NTNC system and a transient, non-community or TNC system. A NTNC system could be a school or a factory with its own water supply where the same people drink the water throughout the year, but not 24 hours a day. A TNC system example is a motel with its own well.
- 3-2.29 Rem. The unit of dose equivalent from ionizing radiation to the total body or any internal organ or organ system. A "millirem (mrem)" is 1/1000 of a rem.
- 3-2.30 Repeat Compliance Period. Any subsequent compliance period after the initial compliance period.
- 3-2.31 Residual Disinfectant Concentration ("C" in CT calculations). The concentration of disinfectant measured in mg/L in a representative sample of water.
- 3-2.32 Sanitary Survey. An on site review of the water source, facilities, equipment, operation and maintenance of a public water system for the purpose of evaluating the adequacy of such elements for producing and distributing potable water.
- 3-2.33 Service Line Sample. A one-liter sample of water collected in accordance with Criteria 3-3.2.d., that has been standing for at least 6 hours in a service line.
- 3-2.34 Surface Water. All water which is open to the atmosphere and subject to surface runoff.
- 3-2.35 Total Trihalomethanes (TTHM). The sum of the concentration in milligrams per liter of the trihalomethane compounds (trichloromethane [**chloroform**], **dibromochloromethane**, **bromodichloromethane** and tribromomethane [**bromoform**]), rounded to two significant figures.
- 3-2.36 Trihalomethane (THM). One of the family of organic compounds, named as derivatives of methane, wherein three of the four hydrogen atoms in methane are each substituted by a halogen atom in the molecular structure.

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3-2.37 Underground Injection. A subsurface emplacement through a bored, drilled, driven or dug well where the depth is greater than the largest surface dimension, whenever a principle function of the well is the emplacement of any fluid.

3-2.38 Vulnerability Assessment. An evaluation by DOD which shows that contaminants of concern either have not been used in a watershed area or the source of water for the system is not susceptible to contamination. Susceptibility is based on prior occurrence, vulnerability, assessment results, environmental persistence and transport of the contaminants, and any wellhead protection program results.

3-2.39 Water System. Refers to both a PWS and an NPWS, and purchasers who have a distribution system and water storage facilities.

3-3 CRITERIA

3-3.1 DOD installations, regardless of whether they produce or purchase water, will execute the following actions:

- a. Maintain a current map/drawing of the complete potable water system.
- b. Update the potable water master system master plan at least every five years to include a projection on the water usage for the next five years to include consideration for troop movements, and facilities construction and demolition..
- c. Protect all water supply aquifers (groundwater) and surface water sources from contamination by suitable placement and construction of wells, by suitable placing of the new intake (heading) to all water treatment facilities, by siting and maintenance of septic systems and on-site treatment units, and by appropriate land use management on DOD installations.
- d. Conduct sanitary surveys of the water system at least annually and as warranted, including review of required water quality analyses. If possible, off-installation surveys will be coordinated with host nation authorities.
- e. Determine the type of water sources and provide proper treatment for all water sources. Surface water supplies, including Groundwater Under the Direct Influence of Surface Water (GWUDISW), must conform to the surface water treatment requirements set forth in Table 3-1. Minimally, groundwater supplies must be disinfected.
- f. Maintain a continuous positive pressure in the water distribution system.
- g. Perform water distribution system operation and maintenance practices consisting of maintenance of a disinfectant residual throughout the water distribution system (except where an effective ultraviolet or ozone disinfectant process is used), proper repair and replacement of mains procedures (including disinfection and bacteriological testing), an effective annual water main flushing program, proper operation and maintenance of storage tanks and reservoirs, and maintenance of distribution systems appurtenances (including hydrants and valves).
- h. Establish an effective cross-connection control and backflow prevention program, to include annual testing of backflow prevention devices.
- i. Regulate underground injection on DOD installations to protect underground water sources. At a minimum, conduct monitoring to determine the effects of any underground injection wells on nearby groundwater supplies.
- j. Develop and update as necessary an emergency contingency plan to ensure the provision of potable water despite interruptions from natural disasters and service interruptions. Minimally, the plan will include:

- (1) Identification of key personnel
 - (2) Procedures to restore service
 - (3) Procedures to isolate damaged lines
 - (4) Identification of alternate water supplies
 - (5) Installation public notification procedures
 - (6) A vulnerability assessment
- k. Use only lead-free pipe, solder, flux, and fittings in the installation or repair of water systems and plumbing systems for drinking water. Provide installation public notification concerning the lead content of materials used in distribution or plumbing systems, or the corrosivity of water that has caused leaching which indicates a potential health threat if exposed to leaded water, and remedial actions which may be taken.
- l. Maintain records showing monthly operating reports for at least 3 years, and records of bacteriological results for not less than 5 years, and chemical results for not less than 10 years.
- m. Document corrective actions taken to correct breaches of criteria and maintain such records for at least three years.

3-3.2 DOD installations, regardless of whether they produce or purchase water, will ensure conformance with the following:

a. Total coliform bacteria requirements:

- (1) An installation commander responsible for a PWS will conduct a bacteriological monitoring program to ensure the safety of water provided for human consumption and allow evaluation with the total coliform-related Maximum Contaminant Level (MCL). MCL is based only on the presence or absence of total coliforms. The MCL must include no more than 5 percent positive samples per month, and no more than one positive sample per month when a system analyzes less than 40 samples per month. When a routine sample is positive for fecal coliforms or *E. Coli*, or any repeat sample is positive for total coliforms, it exceeds MCL.
- (2) Installation must develop a written, site-specific monitoring plan for each system and collect routine samples according to Table 3-2.
- (3) Systems with initial samples testing positive for total coliforms will collect repeat samples as soon as possible, preferably the same day. Repeat sample locations are required at the same tap as the original sample plus an upstream and a downstream sample in the vicinity of the tap. Any additional repeat sampling which may be required will be performed according to local medical or Executive Agent guidance. Monitoring will continue until total coliforms are no longer detected.
- (4) When any routine or repeat sample tests positive for total coliforms, it will be tested for fecal coliform or *E. Coli*. Fecal-type testing can be foregone on a total coliform positive sample if fecal or *E. Coli* are assumed to be present.
- (5) If a system has exceeded the MCL, the installation will complete the notification in Section 3-3.3, no later than the end of the next business day that an acute risk to public health may exist.

b. Inorganic chemical requirements:

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- (1) An installation commander responsible for a PWS will ensure that the inorganic chemicals in water distributed to end users do not exceed the limitations set out in Table 3-3.
- (2) Systems will be monitored for inorganic chemicals at the frequency set in Table 3-4.
- (3) If a system is out of compliance, the installation will complete the notification in Section 3-3.3 as soon as possible, but in no case later than 14 days after the condition. If the installation is only monitoring annually on the basis of a waiver from the Executive Agent, it will immediately increase monitoring in accordance with Table 3-4 until authorities determine the system is reliable and consistent and remedial actions completed.

c. Fluoride requirements:

- (1) An installation commander responsible for a PWS will ensure that the fluoride content of drinking water does not exceed the MCL of 4 mg/L stated in Table 3-3.
- (2) Systems will be monitored for fluoride by collecting one treated water sample at the entry point to the distribution system annually for surface water systems and one every three years for groundwater systems. Daily monitoring is recommended for systems practicing fluoridation using the criteria in Table 3-5.
- (3) If any sample exceeds the MCL, the installation will complete the notification in Section 3-3.3 as soon as possible, but in no case later than 14 days after the violation.

d. Lead and copper requirements:

- (1) DOD PWS and NTNC water systems will comply with the action levels (distinguished from the MCL) of 0.015 mg/L for lead and 1.3 mg/L for copper to determine if corrosion control treatment, public education, and removal of lead service lines, if appropriate, are required. Actions are triggered if the respective lead and copper levels are exceeded in more than 10 percent of all sampled taps.
- (2) Affected DOD systems will conduct monitoring in accordance with Table 3-6. High risk sampling sites will be targeted by conducting a materials evaluation of the distribution system. Sampling sites will be selected as stated in Table 3-6.
- (3) If an action level is exceeded, the installation will collect additional water quality samples. Optimal corrosion control treatment will be pursued. If action levels are exceeded after implementation of applicable corrosion control and source water treatment, lead service lines will be replaced if the lead service lines cause the lead action level to be exceeded. The installation commander will implement an education program for installation personnel (including U.S. and host nation) within 60 days and will complete the notification in Section 3-3.3 as soon as possible, but in no case later than 14 days after the violation.
- (4) All tap samples for lead and copper, with the exception of lead service line samples, shall be first draw samples.
- (5) Each first draw tap sample for lead and copper shall be one liter in volume and have stood motionless in the plumbing system of each sampling site for at least six hours. First draw samples from residential housing shall be collected from the cold water kitchen tap or bathroom sink tap. First draw samples from a non-residential building shall be collected at an interior tap from which water is typically drawn for consumption. First draw samples may be collected by the system or the system may allow residents to collect first draw samples after instructing the residents of the sampling procedures specified in this paragraph. To avoid problems of residents handling nitric acid, acidification of first draw samples may be done up to 14 days after the sample is collected. If the sample is not acidified immediately after collection, then the sample must stand in the original container for at least 28 hours after acidification.

- (6) Each service line sample shall be one liter in volume and have stood motionless in the lead service line for at least six hours. Lead service line samples shall be collected in one of the following three ways:
 - (a) At the tap after flushing the volume of water between the tap and the lead service line. The volume of water shall be calculated based on the interior diameter and length of the pipe between the tap and the lead service line;
 - (b) Tapping directly into the lead service line; or
 - (c) If the sampling site is a building constructed as a single-family residence, allowing the water to run until there is a significant change in temperature which would be indicative of water that has been standing in the lead service line.
- e. Synthetic organic chemical requirements:
 - (1) An installation commander responsible for a PWS will ensure that synthetic organic chemicals in water distributed to people do not exceed the limitations delineated in Table 3-7.
 - (2) Systems will be monitored for synthetic organic chemicals according to the schedule stated in Table 3-8.
 - (3) If a system is out of compliance, complete the notification in Section 3-3.3 as soon as possible, but in no case later than 14 days after the violation. The installation immediately will begin quarterly monitoring and will increase quarterly monitoring if the level of any contaminant is at its detection limit but less than its MCL as noted in Table 3-8, and will continue until the installation commander determines the system is reliable and consistent, and any necessary remedial measure are implemented.
- f. Total trihalomethanes requirements:
 - (1) Installation commander responsible for a PWS will ensure water that has been treated with a disinfectant (oxidant, such as chlorine, chlorine dioxide, chloramines, or ozone) to any part of its treatment process meets the MCL for drinking water of 0.10 mg/L for total trihalomethanes.
 - (2) Systems that add a disinfectant will monitor total trihalomethanes in accordance with Table 3-9.
 - (3) If a system is out of compliance, the installation will complete the notification in Section 3-3.3 as soon as possible, but in no case later than 14 days after the violation, and undertake remedial measures.
- g. Radionuclide requirements:
 - (1) An installation commander responsible for a PWS and NTNC systems will test the system for compliance with the applicable radionuclide limits contained in Table 3-10.
 - (2) Systems will perform radionuclide monitoring as stated in Table 3-10.
 - (3) If the average annual maximum contaminant level for gross alpha activity, total radium, or gross beta is exceeded, the installation will inform the appropriate host nation authorities and the public according to the procedures in Section 3-3.3 as soon as possible, but in no case later than 30 days after the violation, and continue monitoring until remedial actions are completed and the average annual concentration does not longer exceed the respective MCL. Continued monitoring for gross alpha related contamination will occur quarterly, while gross beta related monitoring will be monthly. If any gross beta MCL is exceeded, the major radioactive components will be identified.

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- h. Surface water treatment requirements. DOD water systems employing surface water sources or GWUDISW will meet the surface water treatment requirements delineated in Table 3-1.
- i. Turbidity requirements. DOD PWS filtered waters will be tested daily for turbidity. If the monthly average of the daily samples exceeds 1 NTU in more than 5 percent of the samples, or if the average of two consecutive days exceeds 5 NTU, the installation will complete the notification in Section 3-3.3 as soon as possible, but in no case later than 14 days after the violation.
- j. Non-public water systems. DOD NPWSs will be minimally monitored for total coliforms and disinfectant residuals in accordance with Table 3-2.
- k. Alternative water supplies. If necessary, DOD installations will utilize only alternative water sources including POE/POU treatment devices and bottled water supplies which are approved by the installation commander.
- l. Waivers. Only COMUSJAPAN may grant waivers for the monitoring requirements in this Section. The Executive Agent may also change the monitoring requirements in the future.

3-3.3 Notification Requirements

- a. Public notice. When a DOD water system is confirmed to be out of compliance by retesting or other means as set forth in the preceding criteria, the Executive Agent and installation personnel (U.S. and host nation) will be notified. The notice will provide a clear and readily understandable explanation of the violation, any potential adverse health effects, the population at risk, the steps that the system is taking to correct the violation, the necessity for seeking alternative water supply, if any, and any preventive measures the consumer should take until the violation is corrected. Written notification should be in English and Japanese. The Executive Agent will coordinate notification of host authorities in cases where off-post populations are at risk. See Appendix B for additional notification procedures.
- b. Mandatory health effects language. When providing the information on potential adverse health effects required by paragraph (a) of this section in notices of violations of maximum contaminant levels or treatment technique requirements, or notices of the granting or the continued existence of exemptions or variances, or notices of failure to comply with a variance or exemption schedule, the owner or operator of a public water system shall include the language specified in Appendix B for each contaminant.
(If language for a particular contaminant is not specified below at the time notice is required, this paragraph does not apply.)

3-3.4 Analytical Methods. All samples will be collected and analyzed using USEPA approved methods, or other methods approved by COMUSJAPAN. Approved Japanese and/or other internationally recognized methods will be used for those contaminants where no USEPA approved methods exists.

3-3.5 Compliance Periods. The first three year compliance period will begin 1 Oct 95. Installations may begin earlier with the approval of COMUSJAPAN. This gives installations time to develop a sampling plan and to order sampling supplies. It also will allow installations to budget for it in the coming fiscal year.

**TABLE 3-1
SURFACE WATER TREATMENT REQUIREMENTS**

1. Unfiltered Systems

- a. Systems which use unfiltered surface water or groundwater under the direct influence of surface water will analyze the raw water for total coliforms or fecal coliforms at least weekly and for turbidity at least daily for a minimum of one year. If the total coliforms and/or fecal coliforms exceed 100/100 mL and 20/100 mL, respectively, appropriate filtration must be applied. Appropriate filtration must also be applied if turbidity exceeds 1 NTU.
- b. Disinfection must achieve at least 99.9 percent inactivation of *Giardia Lamblia* Cysts and 99.99 percent inactivation of viruses by meeting applicable CT values.
- c. Disinfection systems must have redundant components to ensure uninterrupted disinfection during operational periods.
- d. Daily disinfectant residual monitoring immediately after disinfection is required. Disinfectant residual measurements in the distribution system will be made weekly.
- e. Water in a distribution system with a heterotrophic bacteria concentration less than or equal to 500/mL measured as heterotrophic plate count is considered to have a detectable disinfectant residual.
- f. If disinfectant residuals in the distribution system are undetected in more than 5 percent of monthly samples for two consecutive months, appropriate filtration must be implemented.

2. Filtered Systems

- a. The turbidity of filtered water will be monitored at least daily.
- b. The turbidity of filtered water will not exceed 1 NTU in 95 percent of the analyses in a month, with a maximum of 5 NTU.
- c. Disinfection requirements are identical to those for unfiltered systems.
- d. The sum of filtration removal credit and disinfection must achieve at least 99.9 percent inactivation of *Giardia Lamblia* Cysts and 99.99 percent inactivation of viruses by meeting applicable CT values.

**TABLE 3-2
TOTAL COLIFORM MONITORING FREQUENCY**

Population Served			Minimum Number of Routine Samples per Month
25	to	1,000 ¹	1
1,001	to	2,500	2
2,501	to	3,300	3
3,301	to	4,100	4
4,101	to	4,900 ²	5
4,901	to	5,800	6
5,801	to	6,700	7
6,701	to	7,600	8
7,601	to	8,500	9
8,501	to	12,900	10
12,901	to	17,200	15
17,201	to	21,500	20
21,501	to	25,000	25
25,001	to	33,000	30
33,001	to	41,000	40

Notes:

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1. A non-public water system using groundwater and serving 1,000 or less people may monitor once in each calendar quarter during which the system provides water provided a sanitary survey conducted within the last five years shows the system is supplied solely by a protected groundwater source and free of sanitary defects.
2. Systems serving less than 4,900 people which use groundwater and collect samples from different sites may collect all samples on a single day. All other systems must collect samples at regular intervals throughout the month.

**TABLE 3-3
INORGANIC CHEMICAL MCLs**

Contaminant	MCL (mg/L)
Arsenic ¹	0.05
Asbestos ¹	7 million fibers/L (longer than 10 µm)
Barium ¹	2.0
Cadmium ¹	0.005
Chromium ¹	0.1
Copper	Action level only, see section 3-3.2d
Fluoride ²	4.0
Mercury ¹	0.002
Lead	Action level only, see section 3-3.2d
Nitrate ³	10 (as Nitrogen)
Nitrite ³	1 (as Nitrogen)
Total Nitrate and Nitrite ³	10 (as Nitrogen)
Selenium ¹	0.05
Sodium ⁴	See note 4
Antimony ¹	0.006
Beryllium ¹	0.004
Cyanide (as free Cyanide) ¹	See note 5
Nickel ¹	0.1
Thallium ¹	0.002

Notes:

1. MCLs apply to CWS and NTNC systems.
2. Fluoride also has a secondary MCL of 2.0 mg/L. The primary MCL applies only to CWS. See criteria 2.c. above for additional fluoride requirements.
3. MCLs apply to CWS, NTNC, and TNC systems.
4. No MCL established. Monitoring is required so concentration levels can be made available on request. See Section 3-3.2d for copper and lead requirements. Monitoring requirements for lead and copper are shown in Table 3-6.
5. Cyanide - no requirement to monitor for cyanide if a chlorine residual is maintained. Otherwise, MLC is 0.2mg/L.

**TABLE 3-4
INORGANICS MONITORING REQUIREMENTS**

Contaminant	Groundwater Baseline Requirement ¹	Surface Water Baseline Requirement ¹	Trigger that Increases Monitoring ²	Waivers
Arsenic	1 sample / 3 years	Annual sample	>MCL	
Asbestos ³	1 sample / 9 years	1 sample / 9 years	>MCL	Yes ⁴
Barium	1 sample / 3 years	Annual sample	>MCL	
Cadmium	1 sample / 3 years	Annual sample	>MCL	
Chromium	1 sample / 3 years	Annual sample	>MCL	
Fluoride	1 sample / 3 years	Annual sample	>MCL	
Mercury	1 sample / 3 years	Annual sample	>MCL	
Nitrate	Annual sample	Quarterly	>50% MCL ⁵	Yes ⁶
Nitrite	Annual sample	Quarterly	>50% MCL ⁵	Yes ⁶
Selenium	1 sample / 3 years	Annual sample	>MCL	
Sodium	1 sample / 3 years	Annual sample		
Antimony	1 sample / 3 years	Annual sample	>MCL	
Beryllium	1 sample / 3 years	Annual sample	>MCL	
Cyanide (as free Cyanide)	1 sample / 3 years	Annual sample	>MCL	
Nickel	1 sample / 3 years	Annual sample	>MCL	
Thallium	1 sample / 3 years	Annual sample	>MCL	
Corrosivity ⁷	Once	Once	-----	-----

Notes:

1. Samples shall be taken as follows: Groundwater systems shall take a minimum of one sample at every entry point to the distribution system which is representative of each well after treatment; Surface water systems shall take at least one sample at every entry point to the distribution system after any application of treatment or in the distribution system at a point which is representative of each source after the treatment.
2. Increased monitoring requires a minimum of 2 quarterly samples for groundwater systems and at least 4 quarterly samples for surface water systems

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3. Systems that are vulnerable to asbestos contamination due solely to source water shall monitor in accordance with note 1. A system vulnerable to asbestos contamination due to corrosion of asbestos-cement pipe shall take one sample at a tap served by asbestos-cement pipe.
4. Necessity for analysis is predicated upon a vulnerability assessment conducted by the PWS
5. Increased quarterly monitoring shall be undertaken for nitrate and nitrite if a sample is >50% of the MCL
6. The DOD Executive Agent may reduce repeat sampling frequency if after 1 year <50% of MCL. Surface water systems may reduce to an annual sample if <50% of the MCL for 1 year.
7. PWSs shall be analyzed within one year of the effective date of country-specific Japan Environmental Governing Standards to determine the corrosivity of water entering the distribution system

**TABLE 3-5
RECOMMENDED FLUORIDE CONCENTRATIONS
AT DIFFERENT TEMPERATURES**

Annual Average of Maximum Daily Air Temperatures (°F)	Control Limits (mg/L)		
	Lower	Optimum	Upper
50.0-53.7	0.9	1.2	1.7
53.8-58.3	0.8	1.1	1.5
58.4-63.8	0.8	1.0	1.3
63.9-70.6	0.7	0.9	1.2
70.7-79.2	0.7	0.8	1.0
79.3-90.5	0.6	0.7	0.8

**TABLE 3-6
MONITORING REQUIREMENTS FOR LEAD, COPPER, AND
WATER QUALITY PARAMETERS**

Population Served	No. of sites for standard monitoring ^{1,2}	No. of sites for reduced monitoring ³	No. of sites for water quality parameters ⁴
>100,000	100	50	25
10,001-100,000	60	30	10
3,301-10,000	40	20	3
501-3,300	20	10	2
101-500	10	5	1
<100	5	5	1

Notes:

- Every six months for lead and copper.
- Sampling sites shall be based on a hierarchical approach. For CWS, priority will be given to single family residences which contain copper pipe with lead solder installed after 1982, contain lead pipes, or are served by lead service lines; then, structures, including multifamily residences, with the foregoing characteristics; and finally, residences and structures with copper pipe with lead solder installed before 1983. For NTNC systems, sampling sites will consist of structures that contain copper pipe with lead solder installed after 1982, contain lead pipes, and/or are served by lead service lines. First draw samples will be collected from a cold water kitchen or bathroom tap; non-residential samples will be taken at an interior tap from which water is typically drawn for consumption.
- Annually for lead and copper if action levels are met during each of two consecutive six month monitoring periods. Annual sampling will be conducted during the four warmest months of the year.
- Samples will be representative of water quality throughout the distribution system and include a sample from the entry to the distribution system. Samples will be taken in duplicate for pH, alkalinity, calcium, conductivity or total dissolved solids, and water temperatures to allow a corrosivity determination (via a Langelier saturation index or other appropriate saturation index); additional parameters are orthophosphate when a phosphate inhibitor is used and silica when a silicate inhibitor is used.

**TABLE 3-7 A
SEMI-VOLATILE ORGANIC CHEMICAL MCLs**

Semi-Volatile Organic Chemical	MCL (mg/L)	Detection Limit (mg/L)
Herbicides/Pesticides/PCBs		
Alachlor	0.002	0.0002
Atrazine	0.003	0.0001
Carbofuran	0.04	0.0009
Chlordane	0.002	0.0002
2,4-D	0.07	0.0001
1,2-Dibromo-3-chloropropane (DBCP)	0.0002	0.00002
Endrin	0.0002	0.00001
Ethylene dibromide (EDB)	0.00005	0.00001
Heptachlor	0.0004	0.00004
Heptachlor epoxide	0.0002	0.00002
Lindane	0.0002	0.00002
Methoxychlor	0.04	0.0001
PCBs (as decachlorobiphenyls)	0.0005	0.0001

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Pentachlorophenol	0.001	0.00004
Toxaphene	0.003	0.001
2,4,5-TP (Silvex)	0.01	0.0002

**TABLE 3-7 B
ORGANIC CHEMICAL MCLs**

	MCL (mg/L)	Detection Limit (mg/L)
Herbicides/Pesticides/Other OCs		
Benzo[a]pyrene	0.0002	0.00002
Dalapon	0.2	0.001
Di(2-ethylhexyl) adipate	0.4	0.0006
Di(2-ethylhexyl) phthalate	0.006	0.0006
Dinoseb	0.007	0.0002
Diquat	0.02	0.0004
Endothall	0.1	0.009
Glyphosate	0.7	0.006
Hexachlorobenzene	0.001	0.0001
Hexachlorocyclopentadiene	0.05	0.0001
Oxamyl (Vydate)	0.2	0.002
Picloram	0.5	0.0001
Simazine	0.004	0.00007
2,3,7,8-TCDD (Dioxin)	3×10^{-8}	5×10^{-9}
Thiuram ¹	0.006	
Thiobencarb ¹	0.02	

Notes:

1. Japan prohibits the manufacture and use of organochlorines as pesticides.

**TABLE 3-7 C
ORGANIC CHEMICAL MCLs**

Volatile Organic Chemicals (VOCs)	MCL (mg/L)	Detection Limit (mg/L)
Benzene	0.005	0.0005
Carbon tetrachloride	0.005	0.0005
o-Dichlorobenzene	0.6	0.0005
cis-1,2-Dichloroethylene	0.04	0.0005
trans-1,2-Dichloroethylene	0.1	0.0005
1,1-Dichloroethylene	0.007	0.0005
1,1,1-Trichloroethane	0.20	0.0005
1,2-Dichloroethane	0.005	0.0005
1,2-Dichloropropane	0.005	0.0005
Ethylbenzene	0.7	0.0005
Monochlorobenzene	0.1	0.0005
para-Dichlorobenzene	0.075	0.0005
Styrene	0.1	0.0005
Tetrachloroethylene	0.005	0.0005
Trichloroethylene	0.005	0.0005
Toluene	1.0	0.0005
Vinyl Chloride	0.002	0.0005
Xylene (total)	10	0.0005
Dichloromethane	0.005	0.0005
1,2,4-Trichlorobenzene	0.07	0.0005
1,1,2-Trichloroethane	0.005	0.0005
1,3-dichloropropane ¹	0.002	0.0005

Notes:

DRINKING WATER

1. Best available treatment technique relates to polymer addition practices. Each PWS must certify annually that when acrylamide and epihydrochlorin are used in drinking water systems, the combination (or product) of dose and monomer level does not exceed the levels specified as follows:
Acrylamide=0.05% dosed at 1 ppm (or equivalent); Epihydrochlorin=0.01% dosed at 20 ppm (or equivalent).

**TABLE 3-7 D
ORGANIC CHEMICAL MCLs**

Synthetic Organic Chemical	MCL (mg/L)	Detection Limit (mg/L)
Acrylamide	treatment technique ¹	
Epihydrochlorin	treatment technique ¹	

Notes:

1. Best available treatment technique relates to polymer addition practices. Each PWS must certify annually that when acrylamide and epihydrochlorin are used in drinking water systems, the combination (or product) of dose and monomer level does not exceed the levels specified as follows:
Acrylamide=0.05% dosed at 1 ppm (or equivalent); Epihydrochlorin=0.01% dosed at 20 ppm (or equivalent).

**TABLE 3-8
SYNTHETIC ORGANIC CHEMICAL MONITORING REQUIREMENTS**

Contaminant	Groundwater Baseline Requirement ¹	Surface Water Baseline Requirement ¹	Detection Limit Monitoring ²	Waivers
VOCs	Quarterly	Quarterly	>Detection Limit ³	Yes ^{4,5}
Pesticides/PCBs	Four Consecutive Quarterly Samples During Each Compliance Period		>Detection Limit ³	Yes ^{5,6}

Notes:

1. Groundwater systems shall take a minimum of one sample at every entry point to the distribution system which is representative of each well after treatment (hereafter called a sampling point). Surface water systems (or combined surface/ground) shall take a minimum of one sample at points in the distribution system that are representative of each source or at each entry point to the distribution system after treatment (hereafter called a sampling point). Each sample must be taken at the same sampling point unless conditions make another sampling point more representative of each source, treatment plant, or within the distribution system.
2. Increased monitoring requires a minimum of 2 quarterly samples for groundwater systems and at least 4 quarterly samples for surface water systems.
3. Detection limits noted in Table 3-7.
4. Repeat sampling frequency may be reduced to annually if none of the contaminants is detected after one year of quarterly sampling. After a minimum of three years of annual sampling, the Executive Agent may allow the system to reduce to one sample every three years.
5. Monitoring frequency may be reduced if warranted based on a vulnerability assessment by the PWS.
6. Repeat sampling frequency may be reduced to the following if after one round of no detection; systems > 3,300 reduce to 2 consecutive quarterly samples/year per compliance period, or systems <3,300 reduce to 1 sample every 3 years. Samples should be taken during the quarter(s) that previously yielded the highest analytical result(s).

Compliance is based on an annual running average for each sample point for systems monitoring quarterly or more frequently; for systems monitoring annually or less frequently, compliance is based on a single sample, unless the DOD Executive Agent requests a confirmation sample. If a confirmation sample is required, the result must be averaged with the first sampling result and the average used for the compliance determination. A system is out of compliance if any contaminant exceeds the MCL.

**TABLE 3-9
TOTAL TRIHALOMETHANE MONITORING REQUIREMENTS**

Population Served by System	Number of Samples Per Distribution System ¹	Frequency of Samples ²	Type of Sample
10,000 or more	4	Quarterly	Treated
Less than 10,000	1	Annually	Treated

Notes:

1. One of the samples must be taken at a location in the distribution system reflecting the maximum residence time of water in the system but not at a dead end. The remaining samples shall be taken at representative points in the distribution system. Systems that add a disinfectant should have samples analyzed for total trihalomethanes.
2. Compliance is based upon a running yearly average of quarterly samples for systems serving more than 10,000 people. Noncompliance exists if the average exceeds the MCL.

TABLE 3-10
RADIONUCLIDE MCL AND MONITORING REQUIREMENTS

Contaminant	MCL (pCi/L)
Gross Alpha ¹	15
Combined Radium-226 and 228	5
Gross Beta ²	50
Strontium-90	8 ³
Tritium	20,000 ³

MONITORING REQUIREMENTS:

For gross alpha activity and radium-226 and radium-228, systems will be tested once every 4 years. Testing will be conducted using an annual composite of 4 consecutive quarterly samples or the average of four samples obtained at quarterly intervals at a representative point in the distribution system.

Gross alpha only may be analyzed if activity is ≤ 5 pCi/L. Where radium-228 may be present, radium-226 and/or -228 analyses should be performed when activity is > 2 pCi/L. If the average annual concentration is less than half the maximum contaminant level, analysis of a single sample may be substituted for the quarterly sampling procedure. A system with two or more sources having different concentrations of radioactivity shall monitor source water in addition to water from a free-flowing tap. If the installation introduces a new water source, these contaminants will be monitored within the first year after its introduction.

Compliance for gross beta, strontium-90, and tritium may be assumed without further analysis if the average annual concentration of gross beta particle activity is less than 50 pCi/L and if the average annual concentrations of tritium and strontium-90 are less than those listed in Table 3-10, provided, that if both radionuclides are present the sum of their annual dose equivalents to bone marrow shall not exceed 4 millirem/year.

Notes:

1. Gross alpha activity includes radium-226, but excludes radon and uranium.
2. Gross beta activity refers to the sum of beta particle and photon activity from manmade radionuclides. If gross beta exceeds the MCL, i.e., equivalence to a dose of 4 millirem/year, the individual components must be determined.
3. Average annual concentrations assumed to produce a total body or organ dose of 4 mrem/yr.

TABLE 3-11A
CT VALUES (CT_{99.9}) FOR 99.9 PERCENT INACTIVATION OF GIARDIA
LAMBLIA CYSTS BY FREE CHLORINE AT 0.5°C OR LOWER*

Residual (mg/L)	pH						
	≤ 6.0	6.5	7.0	7.5	8.0	8.5	≥ 9.0
≤ 0.4	137	163	195	237	277	329	390
0.6	141	168	200	239	286	342	407
0.8	145	172	205	246	295	354	422
1.0	148	178	210	253	304	365	437
1.2	152	180	215	259	313	376	451
1.4	155	184	221	266	321	387	464
1.6	157	189	228	273	329	397	477
1.8	162	193	231	279	338	407	489
2.0	165	197	236	286	346	417	500
2.2	169	201	242	297	353	426	511
2.4	172	205	247	298	361	435	522
2.6	175	209	252	304	368	444	533
2.8	178	213	257	310	375	452	543
3.0	181	217	286	316	382	460	552

* These CT values achieve greater than a 99.99 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the CT_{99.9} value at the lower temperature and at the higher pH.

TABLE 3-11B
CT VALUES (CT_{99.9}) FOR 99.9 PERCENT INACTIVATION OF GIARDIA
LAMBLIA CYSTS BY FREE CHLORINE AT 5.0° C*

Residual (mg/L)	pH						
	≤6.0	6.5	7.0	7.5	8.0	8.5	≥9.0
≤0.4	97	117	139	166	198	236	279
0.6	100	120	143	171	204	244	291
0.8	103	122	146	175	210	252	301
1.0	105	125	149	179	216	260	312
1.2	107	127	152	183	221	267	320
1.4	109	130	155	187	227	274	329
1.6	111	132	158	192	232	281	337
1.8	114	135	162	196	238	287	345
2.0	116	138	165	200	243	294	353
2.2	118	140	169	204	248	300	361
2.4	120	143	172	209	253	306	368
2.6	122	146	175	213	258	312	375
2.8	124	148	178	217	263	318	382
3.0	126	151	182	221	268	324	389

* These CT values achieve greater than a 99.99 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the CT_{99.9} value at the lower temperature and at the higher pH.

TABLE 3-11C
CT VALUES (CT_{99.9}) FOR 99.9 PERCENT INACTIVATION OF GIARDIA
LAMBLIA CYSTS BY FREE CHLORINE AT 10° C*

Residual (mg/L)	pH						
	≤6.0	6.5	7.0	7.5	8.0	8.5	≥9.0
≤0.4	73	88	104	125	149	177	209
0.6	75	90	107	128	153	183	218
0.8	78	92	110	131	158	189	226
1.0	79	94	112	134	162	195	234
1.2	80	95	114	137	166	200	240
1.4	82	98	116	140	170	208	247
1.6	83	99	119	144	174	211	253
1.8	86	101	122	147	179	215	259
2.0	87	104	124	150	182	221	265
2.2	89	105	127	153	186	225	271
2.4	90	107	129	157	190	230	276
2.6	92	110	131	160	194	234	281
2.8	93	111	134	163	197	239	287
3.0	95	113	137	166	201	243	292

* These CT values achieve greater than a 99.99 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the CT_{99.9} value at the lower temperature and at the higher pH.

TABLE 3-11D
CT VALUES (CT_{99.9}) FOR 99.9 PERCENT INACTIVATION OF GIARDIA
LAMBLIA CYSTS BY FREE CHLORINE AT 15°C*

Residual (mg/L)	pH						
	≤6.0	6.5	7.0	7.5	8.0	8.5	≥9.0
≤0.4	49	59	70	83	99	118	140
0.6	50	60	72	86	102	122	146
0.8	52	61	73	88	105	126	151
1.0	53	63	75	90	108	130	156
1.2	54	64	76	92	111	134	160
1.4	55	65	78	94	114	137	165
1.6	56	66	79	96	116	141	169
1.8	57	68	81	98	119	144	173
2.0	58	69	83	100	122	147	177
2.2	59	70	85	102	124	150	181
2.4	60	72	86	105	127	153	184
2.6	61	73	88	107	129	156	188
2.8	62	74	89	109	132	159	191
3.0	63	76	91	111	134	162	195

* These CT values achieve greater than a 99.99 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the CT_{99.9} value at the lower temperature and at the higher pH.

TABLE 3-11E
CT VALUES (CT_{99.9}) FOR 99.9 PERCENT INACTIVATION OF GIARDIA
LAMBLIA CYSTS BY FREE CHLORINE AT 20°C*

Residual (mg/L)	pH						
	≤6.0	6.5	7.0	7.5	8.0	8.5	≥9.0
≤0.4	36	44	52	62	74	89	108
0.6	38	45	54	64	77	92	109
0.8	39	46	55	66	79	95	113
1.0	39	47	56	67	81	98	117
1.2	40	48	57	69	83	100	120
1.4	41	49	58	70	85	103	123
1.6	42	50	59	72	87	105	126
1.8	43	51	61	74	89	108	129
2.0	44	52	62	75	91	110	132
2.2	44	53	63	77	93	113	135
2.4	45	54	65	78	95	115	138
2.6	46	55	66	80	97	117	141
2.8	47	56	67	81	99	119	143
3.0	47	57	68	83	101	122	146

* These CT values achieve greater than a 99.99 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the CT_{99.9} value at the lower temperature and at the higher pH.

TABLE 3-11F
CT VALUES (CT_{99.9}) FOR 99.9 PERCENT INACTIVATION OF GIARDIA
LAMBLIA CYSTS BY FREE CHLORINE AT 25°C*

Residual (mg/L)	pH						
	≤6.0	6.5	7.0	7.5	8.0	8.5	≥9.0
≤0.4	24	29	35	42	50	59	70
0.6	25	30	36	43	51	61	73
0.8	26	31	37	44	53	63	75
1.0	26	31	37	45	54	65	78
1.2	27	32	38	46	55	67	80
1.4	27	33	39	47	57	69	82
1.6	28	33	40	48	58	70	84
1.8	29	34	41	49	60	72	86
2.0	29	35	41	50	61	74	88
2.2	30	35	42	51	62	75	90
2.4	30	36	43	52	63	77	92
2.6	31	37	44	53	65	78	94
2.8	31	37	45	54	66	80	96
3.0	32	38	46	55	67	81	97

* These CT values achieve greater than a 99.99 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the CT_{99.9} value at the lower temperature and at the higher pH.

TABLE 3-11G
CT VALUES (CT_{99.9}) FOR 99.9 PERCENT INACTIVATION OF GIARDIA LAMBLIA CYSTS BY CHLORINE
DIOXIDE AND OZONE*

Temperature (°C)						
	<1	5	10	15	20	≥25
Chlorine Dioxide	63	26	23	19	15	11
Ozone	2.9	1.9	1.4	0.95	0.72	0.48

* These CT values achieve greater than a 99.99 percent inactivation of viruses. CT values between the indicated temperatures may be determined by linear interpolation. If no interpolation is used, use the CT_{99.9} value at the lower temperature for determining CT_{99.9} values between indicated temperatures.

TABLE 3-11H
CT VALUES (CT_{99.9}) FOR 99.9 PERCENT INACTIVATION OF GIARDIA
LAMBLIA CYSTS BY CHLORAMINES*

Temperature (°C)						
	<1	5	10	15	20	≥25
Chloramines	3,800	2,200	1,850	1,500	1,100	750

* These CT values are for pH values of 6 to 9. These CT values may be assumed to achieve greater than a 99.99 percent inactivation of viruses only if chlorine is added and mixed in the water prior to the addition of ammonia. If this condition is not met, the system must demonstrate, based on on site studies or other information that the system is achieving at least 99.99 percent inactivation of viruses. CT values between the indicated temperatures may be determined by linear interpolation. If no interpolation is used, use the CT_{99.9} value at the lower temperature for determining CT_{99.9} values between indicated temperatures.

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